PYELONEPHRITIS: A CRITICAL REVIEW OF 100 CASES *

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This study is based on a critical review of one hundred cases of pyelonephritis, in which a complete urological investigation has been carried out. Pyelonephritis in children and infections occurring secondary to stone, urethral obstruction, prostatic obstruction, or in association with cerebrospinal syphilis, have not been included. This narrows the study, therefore, to the etiology of infections occurring in the kidney secondary to obstructions in the ureter, malpositions of the kidney, or malpositions of the pelvic organs in women, to the question of constant injury to the kidney as the result of gastro intestinal disturbances, and to the mere accidents of infection occurring here as may occur elsewhere in the body.

Sex—Sixty-nine per cent of the patients were females. This preponderance of females is not accidental and depends upon such factors as pregnancy, malpositions of the uterus and bladder, and infections of the bladder secondary to operative procedures on the pelvic organs. It was found necessary to recommend abortion in four cases of pyelonephritis incident to pregnancy because of extreme toxemia. In seventeen others infection had been firmly established at term, probably by long months of interference with urinary drainage from the kidneys. A few pyelograms have been made of pregnant women which showed considerable dilatation of the ureter. It would be interesting to know how constant a condition this is in pregnancy, and whether it may not be responsible, for infection of the kidney, and for other toxemias of pregnancy.

Pyelonephritis was associated with oöphorectomy in seven instances, hysterectomy in two instances, and with a suspension operation in one instance. Cystoscopic study of the bladder after hysterectomy shows intense congestion and, therefore, it is susceptible to infection and may properly be considered the focus of infection for secondary kidney involvement. Catheterization of the female bladder after pelvic operation has long been held responsible for the undoubted occurrence of infection, but if this is the mode by which infection is introduced, it is only because the bladder has been rendered extremely susceptible by injury, and it would seem that as a result of this hypersusceptibility, it might well become infected in other ways than by the introduction of the catheter. Suspension operations as a cause of pyelonephritis have not been sufficiently emphasized. During the slow descent of the uterus the patency of the ureter may be insured as it gradually assumes new positions and new relationships. When the uterus is lifted a considerable distance and put again into its normal position the ureter may be obstructed, and sufficient stasis may occur to result in infection.

It is therefore recommended that in pelvic procedures, which may result in trauma of the bladder, or in which the uterus is to be shifted in its position, the patient should be given, previous to operation, sufficient urotropin to secure prophylactic antisepsis of the urine.

Age—The following table shows the ages of patients on admission:

From	15	to	19 2
"	20	to	24 10
"	25	to	29 8
"	30	to	34 13
"	35	to	39 11
"	40	to	44 18
"	45	to	49 9
"	50	to	54 11
"	55	to	59 9
"	60	to	64 6
"	65	to	69 3

It is interesting to note how few infections were found to occur in youth. A number of cases of pyelonephritis in young children have come under observation, and pyelonephritis is known to be common in children. However, a study of these cases shows that pyelonephritis has two periods in which it is frequent: one in early childhood and the other in adult life. From this the interesting deduction is warranted that nephritis occurring in children, they must recover spontaneously in the large majority of cases. Not included in this series are three cases of pyelonephritis that have been encountered in childhood and which resulted in the death of one, and marked deterioration in health of the other two. In this type of case pelvic lavage should undoubtedly be carried out.

Types of Infection—The right kidney was infected in 18 and the left in 22 patients. In 60 the infection was bilateral. Eighty-four per cent of the patients showed a bacillus infection, and 16 per cent a coccus infection. Although we have not done sufficient bacteriological work to fully identify the organisms in all of the cases, most of these coccus infections showed more involvement of the bladder and were more frequently associated with surface ulceration and hematuria. These cases also were more resistant to treatment.

Pain—It is astonishing how severe an infection of the kidney may be present without pain of sufficient severity to cause distress. The large majority of the cases complain of only bladder disturbances, and it is the absence of pain in the renal regions which formerly led to so marked a chronicity in this type of infection. Eighty-nine of the cases in this group presented bladder symptoms, leaving a small percentage of eleven in which there were no urinary disturbances. Cases of severe infection of the kidney are sometimes subject to renal pain, usually aching in character, and which may be typically renal in distribution.

In other instances the pain in the back may be associated with pain in the upper abdomen or in the region of McBurney's point on the right side, and a corresponding position on the left side. There are still other instances in which infection of the kidney may be associated only with abdominal pain, and when this pain occurs in the region of the appendix it may be extremely difficult to differentiate between acute infection of the right kidney without appendicitis, and acute infection of the right kidney in association with appendi-

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citis. In either case there is fever, leukocytosis, pain in the region of McBurney's point, and in the actual absence of appendicitis we have observed a slight degree of rigidity and a tendency toward muscle spasm.

Urine—Ninety-five per cent of the cases showed pus in the urine. Sometimes even prolonged observation would show only an occasional pus cell, in spite of the large numbers of bacteria. The absence of pus in all cases of bacterurea has led some to the belief that one of the functions of the kidney is to excrete bacteria. When ureteral catheterized specimen of urine contains bacteria, the kidney is the seat of a definite infection. Prompt smear examination immediately after catheterization are necessary, because if examination is delayed it is impossible to be positive that the infection is in the kidney. The bacteria may be the result of contamination which has been picked up in passing the ureteral catheter through an infected bladder.

Direct slide smears are of more diagnostic value than cultures because cultures are nothing more than a multiplication many times of a misleading contamination. Also it must be remembered that all bacteria do not grow on ordinary laboratory media and many observations have failed to secure satisfactory cultures, even when direct slide smears showed a heavy infection of bacteria.

Macroscopically clear urine may be heavily laden with bacteria, and no urinary examination is of value unless freshly catheterized specimen in the female and freshly voided second-glass specimen in the male are immediately centrifuged and stained. Fifty-nine per cent of the cases showed blood in the urine. Albumen was present in 65 per cent of the cases, and infection was demonstrated in all of them.

Some cases of pyelonephritis have been found associated with parenchymatous nephritis in the same patient. In some of these cases exhaustive searches for focal infection, had been made, but a bacteriologic study of the urine had been neglected. It is possible that infection had occurred in association with a typical parenchymatous nephritis; but if this is the case, infection of the kidney would seem to have played a large part in the renal destruction, for in one of the cases showing a heavy cloud of albumin, the left kidney had been virtually destroyed, and the right reduced considerably in its functional capacity. The kidney itself should be more often considered as a source of its own focal infection, if focal infection bears any great relation to nephritis.

Other Considerations—The fact that pyelonephritis may be latent and is frequently associated with gastro-intestinal disturbances has led some to the belief that pyelonephritis may not be due to fault of the kidney but to constant invasion of the kidney by bacteria as a result of some type of intestinal stasis.

This theory is supported by the frequency of bilateral infection, but infection might well occur on the second side as a result of ascending infection. It is further supported by the frequency of gastro-intestinal disturbances in association with kidney infection, but in such diseases of the kidney as hydronephrosis, tumor, and stone unassociated with infection, it is not uncommon to find gastro-intestinal disturbances of a similar character. If kidney infection were often dependent upon gastro-intestinal stasis, local treatments of the kidney would not often prove successful, or lasting, and it may be that the persistent types of infection in which no stasis of the urine is demonstrated may depend upon constant injury to the kidney through intestinal stasis.

A good many cases of pyelonephritis are undoubtedly dependent upon stasis of the urine as a direct result of obstructions somewhere along the ureter, and dilatation of the ureter is of undoubted value in treating these particular conditions.

CONCLUSIONS

Pyelonephritis occurs more frequently in females than in males, due to pregnancy and gynecological procedures. Gynecological procedures should be preceded by the administration of urinary antiseptics, and these should be continued during convalescence.

Pyelonephritis is extremely common in childhood, is less frequent during youth, and again appears throughout life. From this it is concluded that the large majority of cases occurring in children spontaneously recover. There is an occasional case in which this does not occur and so lowers their resistance as to render them susceptible to other infections proving fatal. Children in whom pyelonephritis exists for a long period of time should be given the benefit of pelvic lavage. There is practically no difference between the right kidney and left kidney in incidence of infection.

Clinical observations of marked bladder disturbances and of infection of the urine subsequently followed by pain in the renal regions and fever have led to the conclusions that ascending infection may occur and probably often accounts for the bilateral nature of the disease.

Pyelonephritis is most often emphasized by bladder disturbances alone, but it may be associated with pain abdominal in type, and when associated with acute infection may be extremely difficult to differentiate from urinary infection associated with appendicitis. Not all cases of pyelonephritis show pus in the urine. Direct slide smears are of more value than cultures. There are infections of the urinary tract other than tuberculosis which, in the absence of urinary antiseptics, will not grow on ordinary media. It is not one of the functions of the kidney to excrete bacteria, and the finding of bacteria in kidney urine is evidence of a pathological process in that kidney. Chronic nephritis associated with infection of the kidney is not uncommon. The presence of large amounts of albumen in these cases has in some instances led to exhaustive studies of other portions of the body for foci of infection with total neglect of the kidney itself as a focus of infection.

Persistent cases of pyelonephritis in which no

stasis is present may have as their cause gastro-intestinal stasis. Pyelograms should be made in cases of persistent pyelonephritis to demonstrate the absence or presence of ureteral stricture.

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PERSONAL OBSERVATIONS ON UNUSUAL FORMS OF ACUTE POLIOMYELITIC PARALYSIS.*

With Remarks on Clinically Related Types of Epidemic Encephalitis and Landry's Paralysis

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Wickman [1] has classified the following clinical forms of poliomyelitis:

1. The spinal poliomyelitis form.
2. The form resembling Landry's paralysis.
3. The bulbar or pontine.
4. The encephalitic.
5. The ataxic.
6. The polyneuritic (resembling neuritis).
7. The meningitic.
8. The abortive.

Weisenburg [2] in a study of 717 cases in the 1916 Philadelphia epidemic modified this classification as follows:

1. The spinal form.
2. The form resembling Landry's paralysis.
3. The pontine bulbar:
   - (a) Bulbar.
   - (b) Pontine.
   - (c) Pontine bulbar.
   - (d) Pontine spinal.
   - (e) Bulbar spinal.
   - (f) Pontine bulbar spinal.
4. Encephalitic.
5. Cerebellar.
6. Meningitic.
7. Abortive.

It will be seen that Weisenburg's classification differs more particularly in the subdivisions of the bulbar types and the omission of the so-called polyneuritic type. In fact, this author is convinced that the pain and tenderness in the affected limbs, which is so marked and characteristic of a certain group, is not at all of neuritic origin. He found at no time pressure over the nerve trunks producing pain. In favor of the view of the meningeal origin of these sensory disturbances is the rapid subsidence of pain following lumbar puncture. In fact, from the standpoint of therapy lumbar puncture was considered indicated and was done in every patient on admission to the hospital and was repeated as occasion arose according to meningeal symptoms and pain.

In the spinal types Weisenburg makes the point that the progression of the paralysis in both upper and lower limbs is from the proximal portions to the distal portions of the limbs. He makes the statement that there is no record of a single instance in which the paralysis started in the parts below the knee and extended upward. In the recession of the paralysis the distal portions cleared up more rapidly than the proximal. A more rapid improvement in the upper extremities took place when contrasted with the lower extremities. A Landry type is spoken of, but is not considered to be as distinct as is commonly supposed.

Wickman classified Landry's paralysis as a form of poliomyelitis. From a study of two unpublished cases of Landry's paralysis—one in which a necropsy was done and the spinal cord and peripheral nerves studied—it is my personal opinion that it is very doubtful whether this is the case.

Charles K. Mills [3] in 1910, studying an outbreak of poliomyelitis in the Lehigh Valley and Philadelphia of that year, mentions cases reported in Norway and Sweden and in this country showing lesions practically identical with those in the cord, also in the cortex and in the basal ganglions. He speaks of the so-called cerebello rubro-spinal symptomatology—coarse tremor with some paresis and rigidity; the whole somewhat like paralysis agitans, or a mixture of this disease and multiple sclerosis. Although on the lookout for this form, Dr. Mills had evidently not met with an example of it.

This brings up the question of the possible identity of epidemic infantile paralysis and epidemic encephalitis, which has been suspected because of the similarity of the histo-pathological picture. The fact that this latter disease has always been associated in epidemic form with influenza; that it is unusual for it to produce lower motor neuron paralysis and atrophies comparable to poliomyelitis; that adults are predominantly affected; that the seasonal prevalence is different; and that no corresponding increase in the number of cases of infantile paralysis occurred when the encephalitis epidemic was at its height: all these would speak against this identity.

Strauss,[4] Loewe and Hirshfeld claim to have demonstrated a filterable virus in epidemic encephalitis, to have cultivated it and by it to have reproduced the disease in animals.

Although morphologically this organism resembles that described by Flexner and Noguchi in poliomyelitis, it acts differently in its infectiousness in different animals, namely, in monkeys and rabbits. Strauss told me personally this summer that he believes that the virus of influenza and epidemic encephalitis are the same.

Thalhimer [5] confirms the above authors on the specificity of this organism.

Riley [6] and others before him have discussed the spinal forms of epidemic encephalitis. Such a classification may lead to the impression that this clinical picture of encephalitis, and poliomyelitis are similar. This has not, however, been my experience. In a study of some twenty-nine personal cases of epidemic encephalitis gotten together over a year ago, and read before the annual meeting of the Pacific Railway Surgeons, no example of a frankly similar picture to acute poliomyelitic paralysis occurred. Riley describes an irritative type and a paralytic type, this latter often being an end result of the former, and included as a type largely on theoretic grounds.

* Read before the San Francisco County Medical Society Meeting of November 1, 1921.